HGTD Testbeam in CERN

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2018-11-09

2018 Program

April – May 2018:

- ✓ Neutron vs Proton Irradiation on Boron implanted CNM 10478 wafers — Completed

June – July 2018:

- ✓ Proton irradiated Carbon diffused wafers CNM 10478 — Completed
- ✓ Un-irradiated Gallium implanted wafers — Completed
- ✓ HPK
- ✓ AltiRoC v 0.1

September 2018:

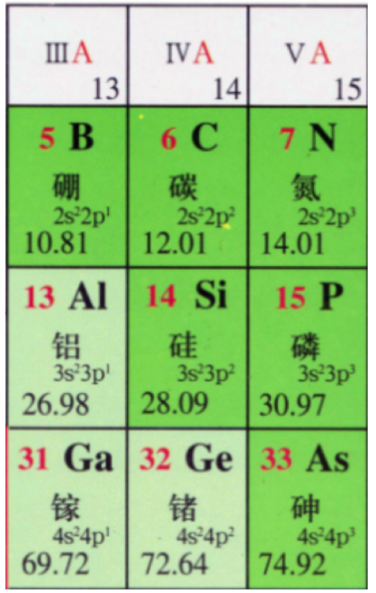
- ✓ Neutron Irradiated Carbon diffused wafers CNM10478 — Completed
- ✓ Proton Irradiated Gallium Wafers — Completed

October 2018:

- ✓ Neutron Irradiated Gallium
- ✓ CNM AIDA – FBK
- ✓ AltiRoC v1.0

1st Article: Proton vs Neutron Irradiation on Carbon diffused born wafers

2nd Article: Gallium effect on radiation hardness of LGAD sensors in Proton vs Neutron irradiation

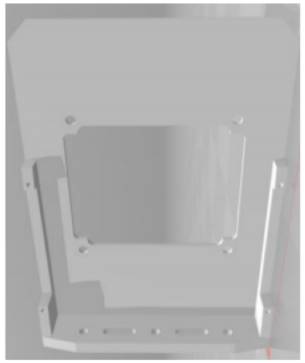


Testbeam Equipment

Mechanics, SiPM and FEi4

Mechanics

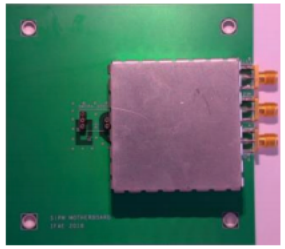
- 10 new board L-shape support brackets
- Easy installation and good alignment
- Simplified mounting
- Closer board distance



SiPMs

- 5 produced, 4 operational
- 3D printed quartz bar support problematic
  - Poor accuracy
  - Insufficient screw retention power
  - Need aluminum or steel mount
- Board performance poorer than expected
- Higher rise time (~1.2nsec) leading to 36psec resolution
- Higher capacitance due to connector pins?

Board



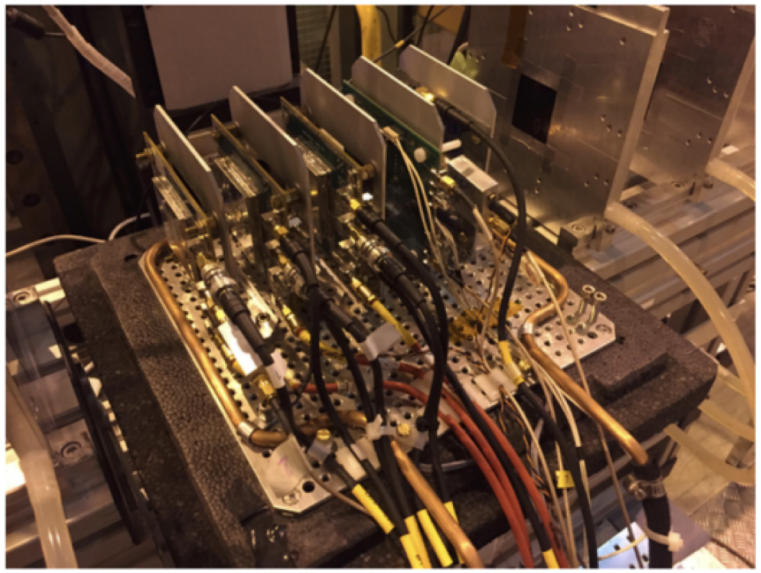
Sensor

MMC3

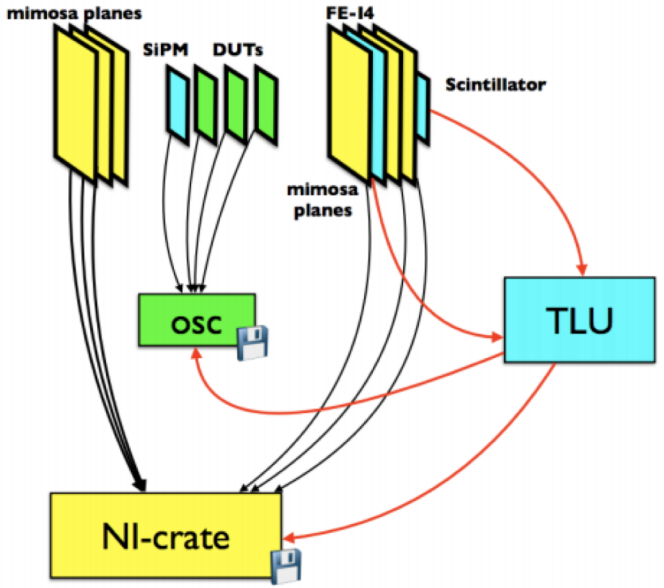
- More stable than USB PiX
- No synchronization bug with telescope events
- Problematic with old FE-i4 A planes, compatibility questionable
- Only one available, belongs to MPI

Setup

- DUTs: LGADs sitting inside a cooling box
- SiPMs: for timing reference which sit in a separate cooling box (closed to light)



(a) Sensors under test



(b) Data acquisition setup

- Mimosa planes: Telescope used for tracking position / efficiency
- FeI4 + Scintillator: used for triggering

- Trigger Logic unit receives signal from FE-I4 and scintillator and sends signal to oscilloscope and NI-crate to save data (two separate files per run)

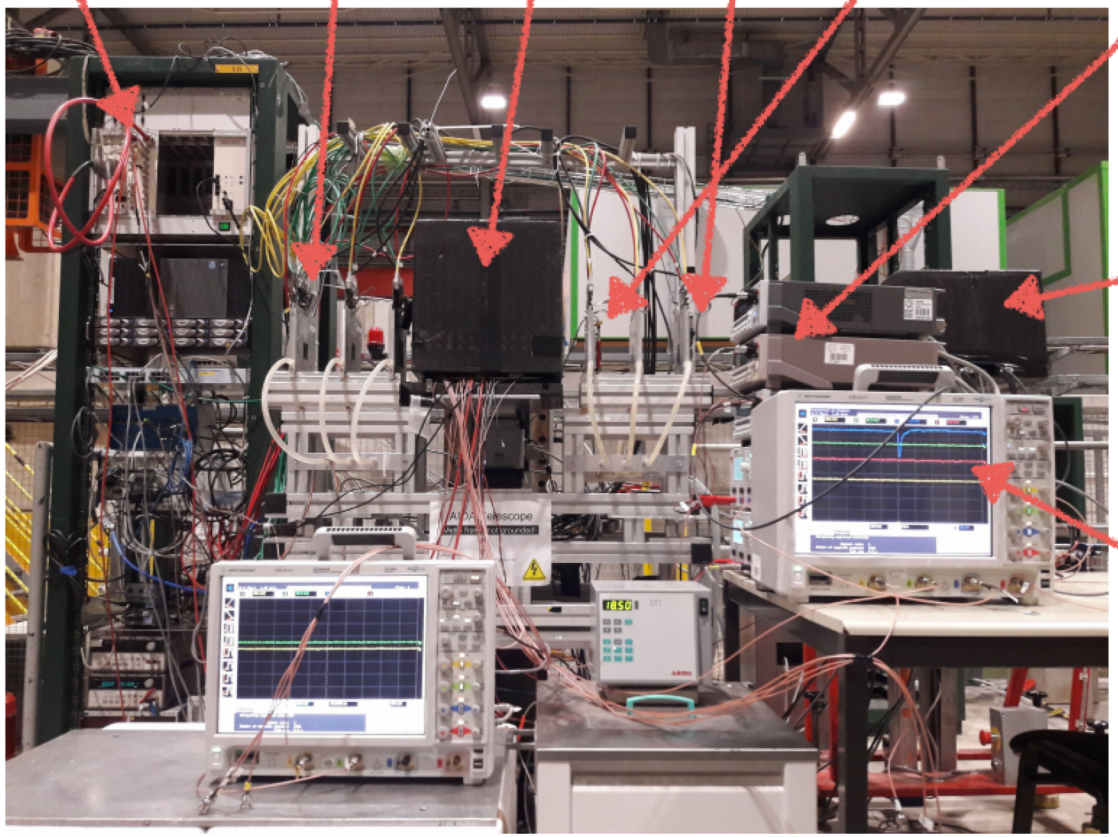
Basic Setup

Telescope: 6 MIMOSA planes and 4 scintillators

HV for DUTs

Cold box for DUTs

FE-I4



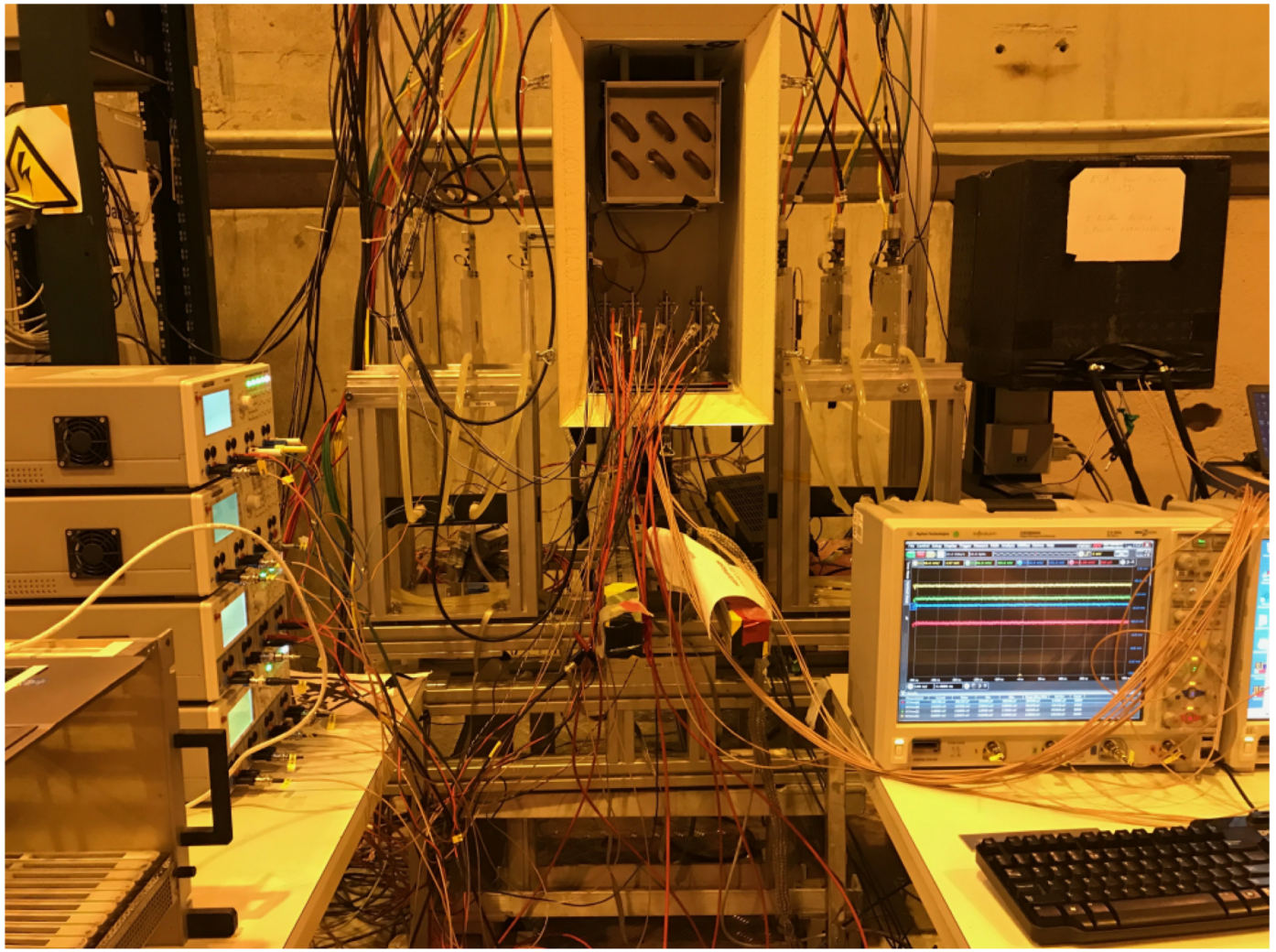
HV for SiPMS
LV for boards and second stage amplifiers

Cold box for SiPMs

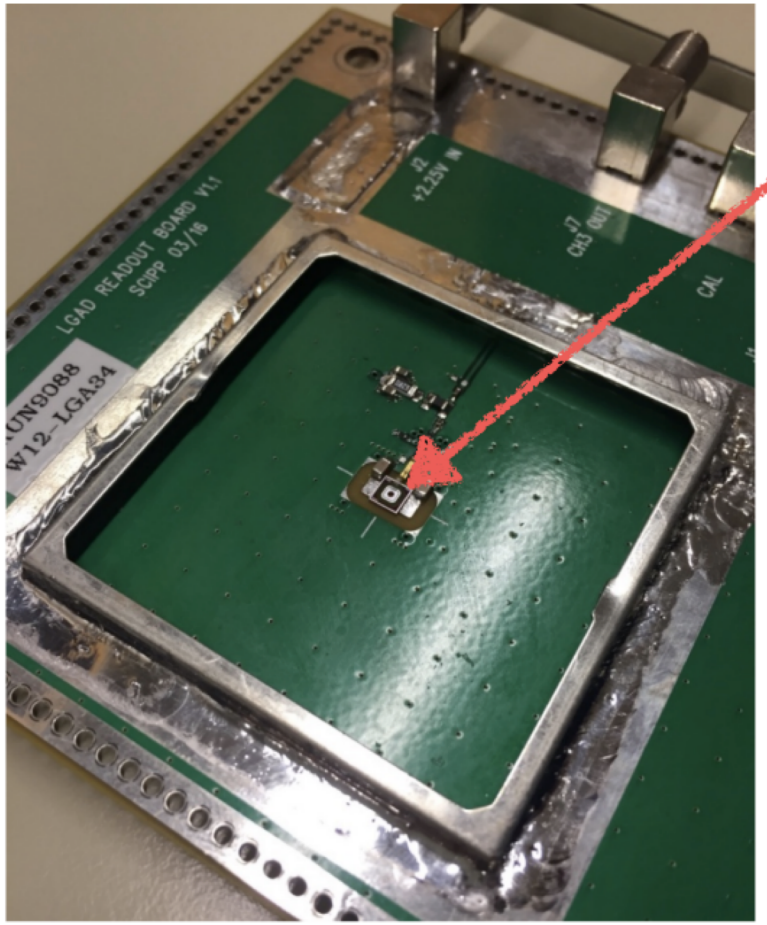
Oscilloscopes for read-out

Signal!

Sensor setup with box open



Sensor and readout boards



- LGAD sensor taped to board
- Wire bonded to readout board
- **Cables:**
- HV in for Sensor - O (100V)
- LV for board - 2.25 V
- Calibration (not used in testbeam)
- CH3 out - signal output
- **An amplifier** is put on the output of the signal —> goes to oscilloscope

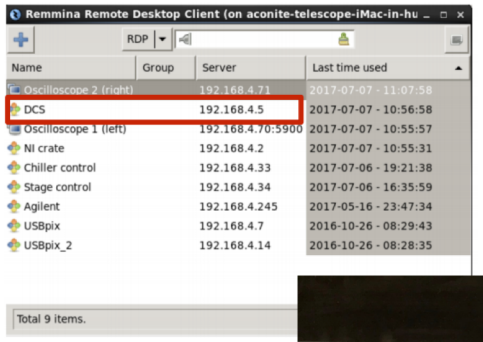
What should I do as a shifter?

- In case someone will take shifts in CERN or BESIII in future, I summarize something about taking shifts.

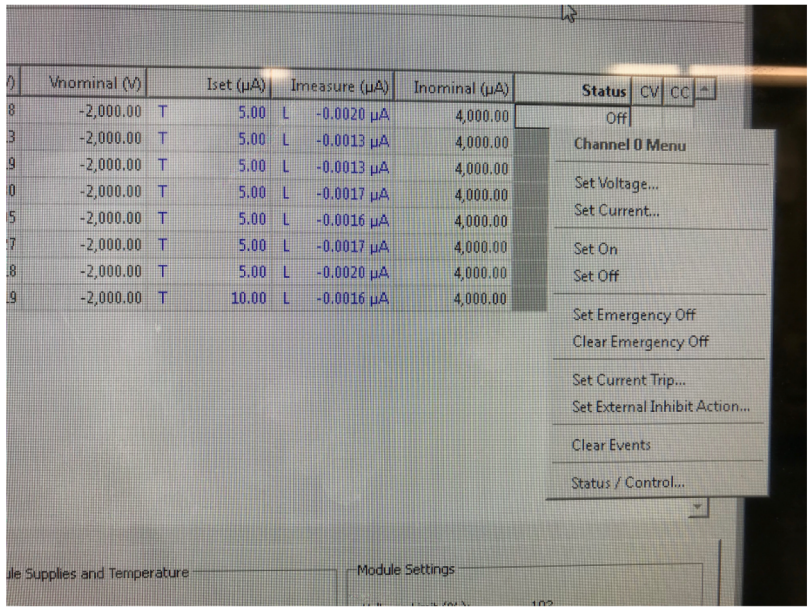
- Preparation
  - CERN account (done by email before arrival)
  - CERN card (building 55)
  - Dosimeter (building 55)
  - Access to The Area (through EDH)
  - Helmet, Protective shoes (paid by group)

What should I do as a shifter?

- Voltage Control

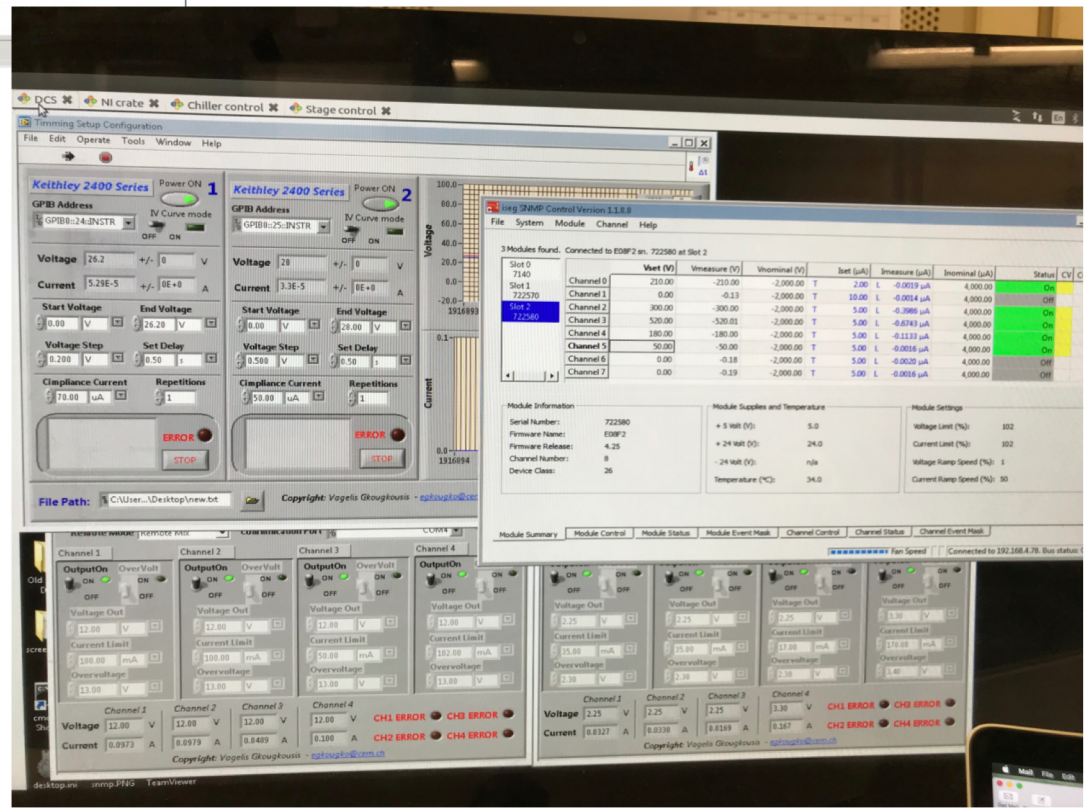


- Set the voltage of the individual sensors from **DCS**
- **Start DCS and check the logbook for which sensors are on which HV channel —> it is not obvious!**
- Set compliance in the Iset value
- Set voltage in Vset -> right click on status -> on



'HV' for SiPMs

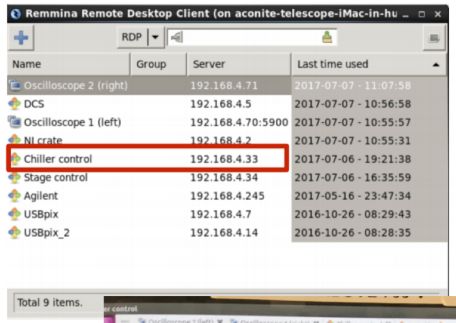
LV for boards and amplifiers



HV for DUTs

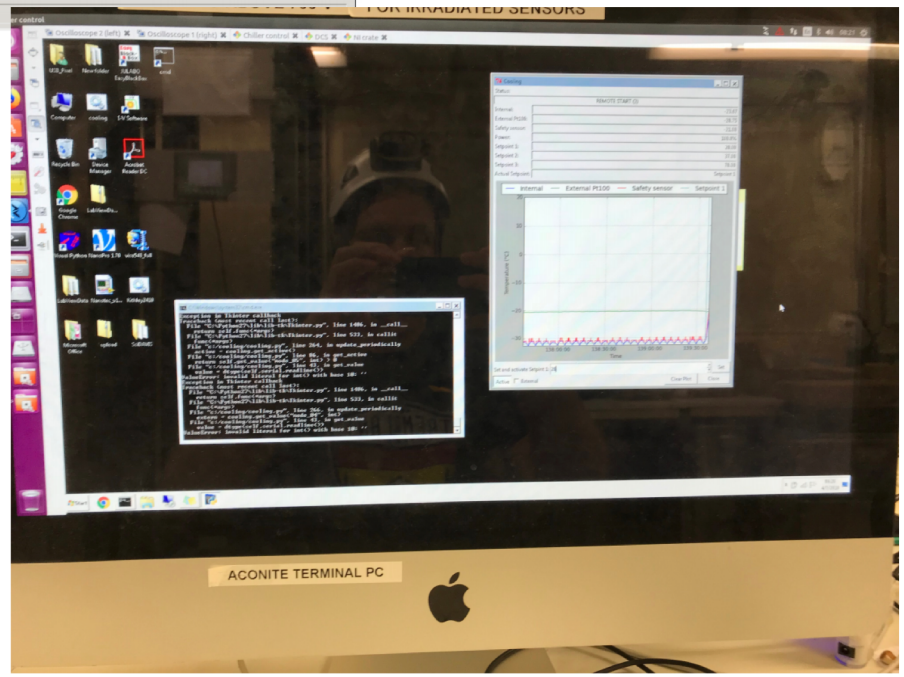
What should I do as a shifter?

- Temperature Control



- Nominally we test sensors at -30 C
- Though could also test sensors at -20 C, so shifter may be asked to change the temperature of the chiller

- Also temperature needs to be ramped to + 20 C ahead of sensor replacements



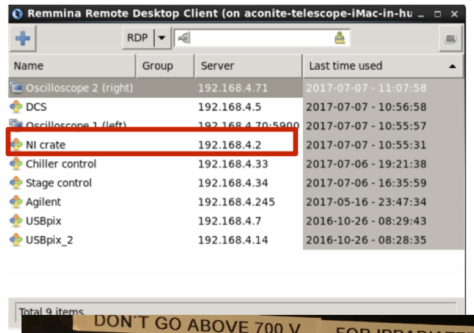
- **Click on Chiller control**

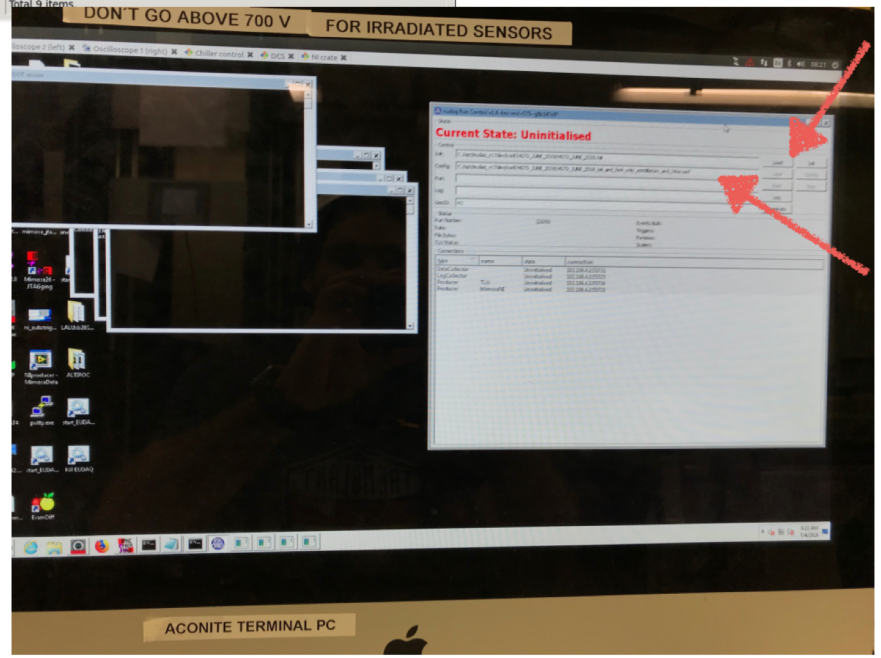
- Set temperature at bottom under:
- **“Set end active Setpoint”**

- Can see the temperature on the graph and in the top status

What should I do as a shifter?

- Start and stop run





- Go to NI crate and start EUDAQ by clicking on icon:
  - **Start EUDET v17!!** *There is more than one EUDET icon!*

- First check initialisation file should be (e.g.):

C:/opt/eudaq_v17dev/conf/HGTD_JUNE_2018/HGTD_JUNE_2018.init

- click initialise (*only experts will modify this file*)
- Load and choose the configuration from the window (*different for every batch*)

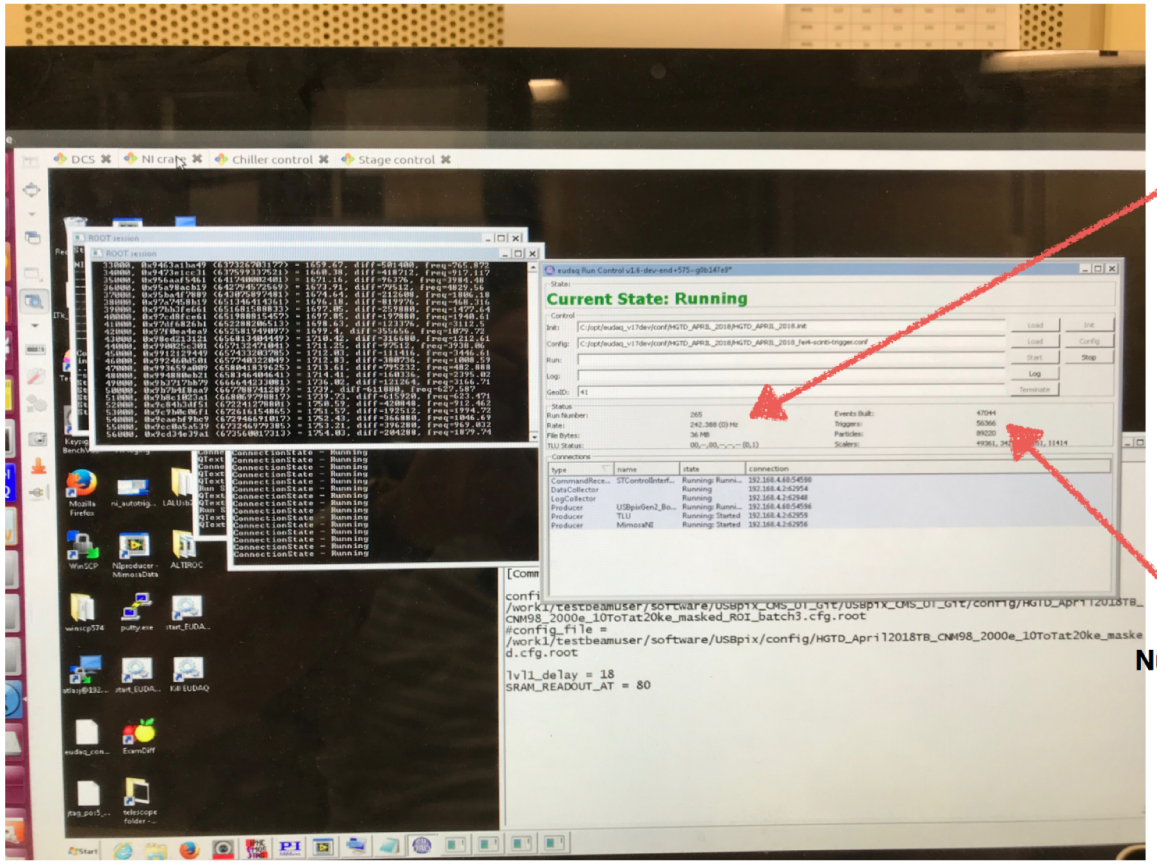
should have dei4_and_scintillator in the name

- *Above is only done when re-starting EUDAQ*
- If all above + DAQ + USBPix done, click start
  - You are now running and taking data!
- Click stop when you want to stop run
  - **Check number of events is -1 DAQ**
  - Copy rate and number of events to log book

What should I do as a shifter?

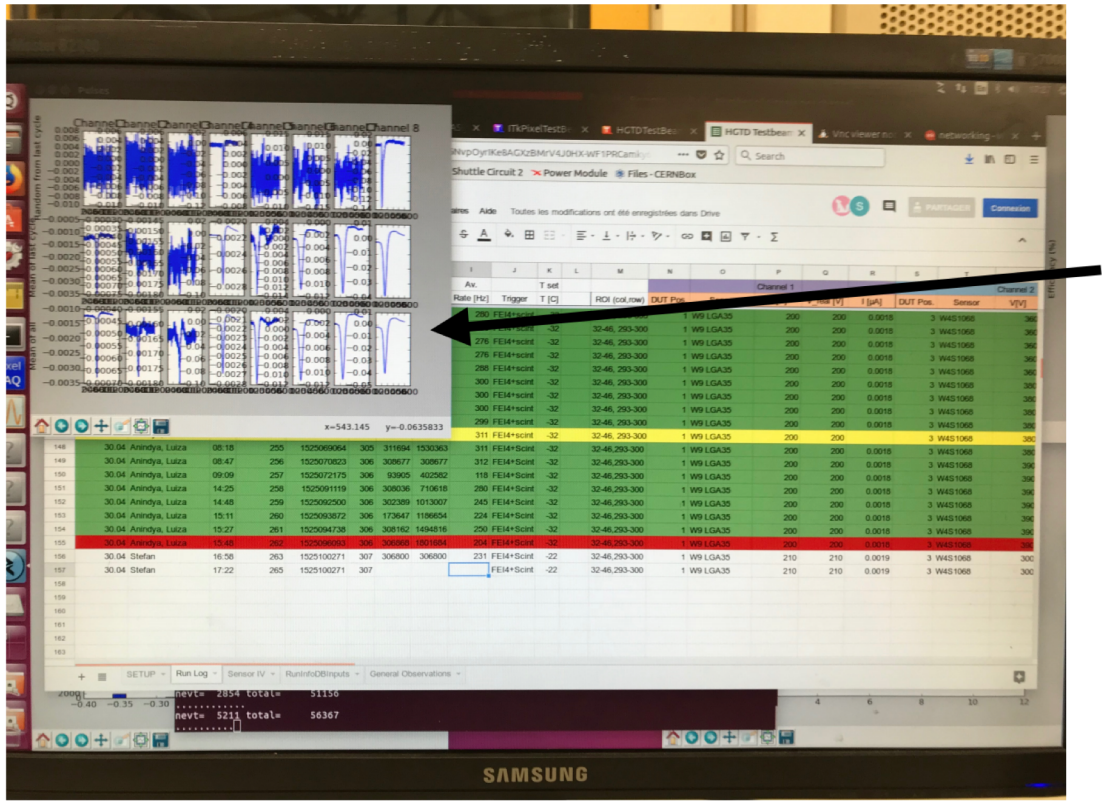
- Check Run Parameters

- Now you are running and taking data!
- **Should monitor rate and number of triggers —> compare with DAQ numbers**



What should I do as a shifter?

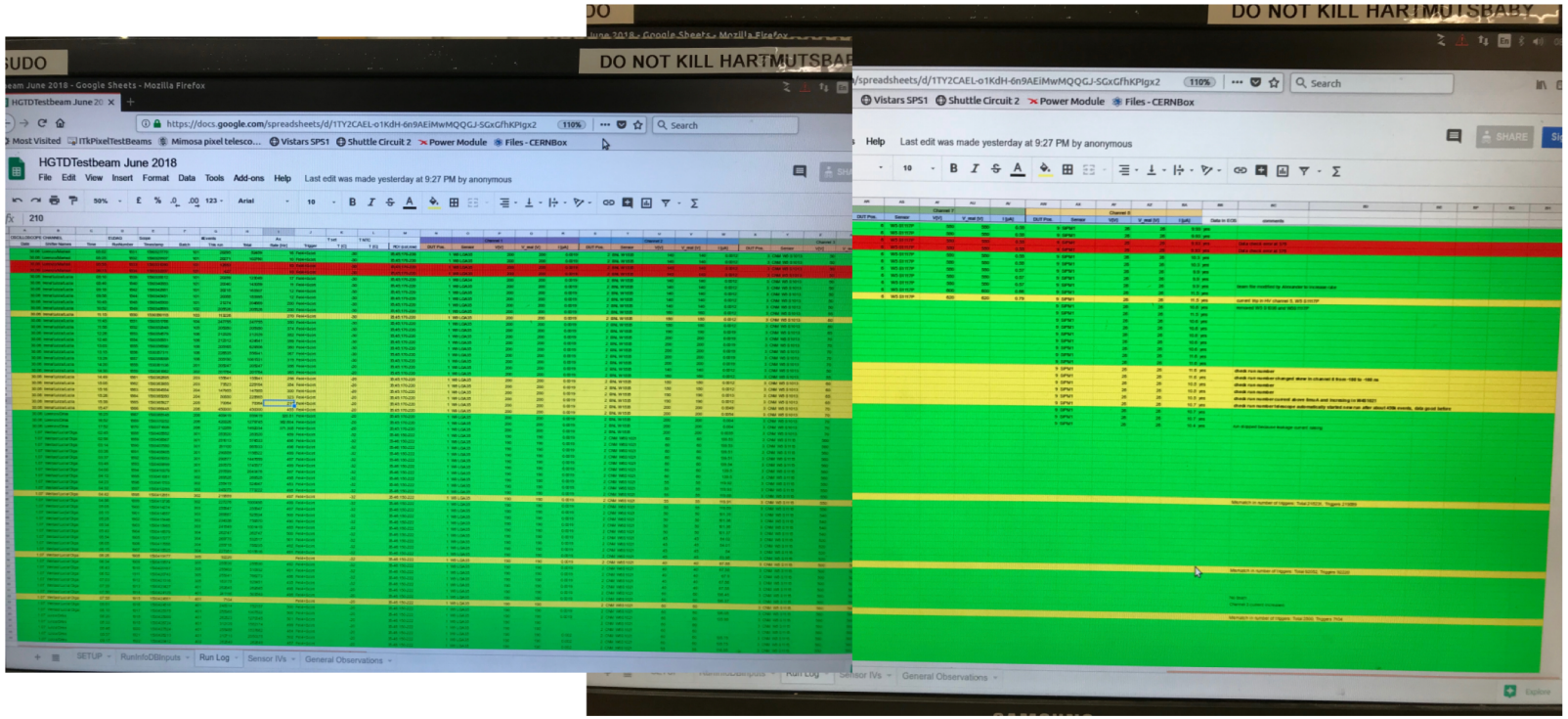
- Check Data Quality
  - Data quality checks are run via a terminal:
  - **python ~/HGTD/June18TB/Monitoring/dataMonitor.py [filename or path]**, where filename is the path to either the dat or the txt file and path is a directory (including subdirectories) to be monitored



- Several pop-up windows
- **One EXTREMELY useful is the signals from the oscilloscope channels**
- Should be checked while data-taking to spot any issues
- Should always see 2 SiPMS, reference LGAD and other signals accordingly

What should I do as a shifter?

- Fill out the Log book
  - **It is required when a run is taken to fill out the information on the google spreadsheet**
    - Can find the link on the specific testbeam twiki page —> should be always on in the hut!
    - Fill out comments!
  - **Check run numbers (both!), rate, sensor positions with voltages and leakage currents (also SiPM)**
    - **Check these every single run!!**



Thank you!